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ORIGINAL ARTICLE

Identifying Generic Predictors of Outcome in Patients Presenting to Primary Care With Nonspinal Musculoskeletal Pain

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Objective. **To identify which generic prognostic factors, such as pain intensity, levels of disability, and psychological factors, are most strongly associated with outcome from musculoskeletal pain, regardless of the location of pain. We tested the hypothesis that pain location does not add predictive value to these generic prognostic models, and that such prognostic factors are equally important across different pain locations.**

Methods. **Data from a prospective observational cohort of primary care patients with acute (n = 413) and chronic (n = 414) nonspinal musculoskeletal pain were used to develop predictive models. The analysis was carried out in 3 steps: derivation of predictive models including generic factors only, investigation of the added predictive value of pain location, and investigation of effect modification by pain location.**

Results. **Generic factors predicted outcome over different time periods (3 months and 12 months) and for both acute and chronic musculoskeletal pain (area under the receiver operating characteristic curve 0.73–0.75). The most consistent predictors of poor outcome were having had the same complaint in the previous year (odds ratio range 2.03–3.46), a lower level of education, lower scores on the Short Form 36 vitality subscale, using pain medication at baseline, and being bothered by the complaint more often in the past 3 months. Pain location variables only slightly improved the predictive ability of the models over generic factors and were inconsistent across the models.**

Conclusion. **Generic factors appear to play an important role in the prognosis of acute and chronic nonspinal musculoskeletal pain, regardless of the location of pain.**

INTRODUCTION

Musculoskeletal disorders are one of the most common causes of disability, especially in older people. Studies suggest that in The Netherlands, the point prevalence of musculoskeletal disorders in adults age >25 years is ~45% (1,2). Musculoskeletal pain is also a common reason for care seeking, especially in primary health care settings where it is typically assessed and managed. It has been reported that the burden of musculoskeletal pain can constitute up to 18% of a general practitioner's workload (3). The prevalence of musculoskeletal disorders and associated pain is expected to increase dramatically in the coming decades as the population ages (4).

In order to provide optimal care to patients with musculoskeletal pain, it is important that primary care clinicians can identify patients who have a higher risk of poor outcome. Most studies that describe the clinical course and prognosis of musculoskeletal pain specifically focus on regional pain syndromes, such as neck pain (5), shoulder pain (6), or low back pain (7). However, while musculoskeletal pain occurs frequently in the population, localized pain that occurs at a single site is relatively rare. Studies suggest that musculoskeletal pain usually coexists with pain in other body regions and that the functional consequences are highly dependent on how widespread the pain is (8). It has been suggested that these different regional pain syndromes share similar underlying attributes and clinical courses.

A recent systematic review of prognostic factors for patients presenting to primary care with musculoskeletal pain reported that despite a high degree of heterogeneity in

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Significance & Innovations

- The aim of the current study was to identify which generic prognostic factors are most strongly associated with outcome of an episode of pain, regardless of the location of pain.
- Generic factors predicted outcome over different time periods (3 months and 12 months) and for both acute and chronic nonspinal musculoskeletal pain.
- The most consistent predictors of poor outcome were having had the same complaint in the previous year, a lower level of education, lower scores on the Short Form 36 vitality subscale, using pain medication at baseline, and being bothered by the complaint more often in the past 3 months.

the study population, design, and analysis, certain prognostic factors consistently emerge (9). Pain characteristics at the time of consultation (such as intensity, duration, or number of previous episodes), levels of disability, and psychological factors (such as anxiety or depression) were all associated with the outcome in multiple studies regardless of the site of pain. Since these factors have predictive value across different regional pain sites, they can be considered to be generic. Similarly, other studies have demonstrated that generic prognostic indicators can be used to determine the prognosis of older people with knee pain (10) or the onset of musculoskeletal pain in a working population (11). When trying to predict which older adults with knee pain will experience persistent difficulties, prognostic factors from the clinical history, physical examination, and radiography results have been shown to be of limited predictive value over generic factors such as age, body mass index, anxiety, and pain severity (12).

These findings support the hypothesis that in patients with musculoskeletal pain, especially in those with chronic pain, generic factors such as demographic variables, pain characteristics (duration and frequency), psychological factors, and social factors are more important in the prediction of outcome (prognosis) than the location of pain. The aim of the current study was to identify which generic prognostic factors are most strongly associated with outcome of an episode of pain, regardless of the location of pain. We tested the hypothesis that pain location does not add a predictive value to these generic prognostic models, and that such prognostic factors are equally important across different pain locations.

PATIENTS AND METHODS

This study was based on a prospective observational cohort of 1,123 primary care patients with nonspinal musculoskeletal pain in The Netherlands (13). Results of the clinical course and prognosis of regional pain syndromes (neck and shoulder pain [14], elbow pain [15], hip pain [16], and knee pain [17]) have been published separately.

Study population. Patients were eligible for participation if they visited their general practitioner with a new episode of pain in the neck, shoulder, elbow, arm, wrist, hand, hip, knee, ankle, or foot; were age ≥18 years; and were capable of filling out Dutch-language questionnaires. An episode was considered new if patients had not visited their general practitioner for the same problem during the preceding 3 months. Patients were excluded from the study if a fracture, malignancy, prosthesis, amputation, or congenital defect caused the symptoms, or if they were pregnant. Additional details about the design and the protocol have been published separately (13).

Baseline variables. Shortly after the initial consultation in primary care, all participants completed a series of questionnaires that contained putative predictors of outcome (13). Based on previous studies in the literature about prognostic factors for musculoskeletal pain, the influence of the following factors was investigated: demographic variables (age, sex, and level of education), pain characteristics (severity, frequency, previous episodes of pain, and reporting of pain in many places), psychological factors (pain coping [18], distress [19], and kinesiophobia [20]), and general health status (physical, emotional, and vitality subscales of the Short Form 36 health survey [SF-36]) (21). The following determinants were also investigated: job characteristics, physical activity during leisure time, and social support.

Outcome measures. Participants were contacted at 3 and 12 months after the initial consultation in primary care, with questionnaires being mailed to all participants. Outcome from musculoskeletal pain was determined by self-report of pain intensity using an 11-point visual analog scale (VAS) and bothersomeness was determined by asking the question, "How often during the past 3 months were you bothered by the current complaint?" For the purpose of this study, a dichotomous outcome measure was created to identify patients with a poor outcome at each followup. A 30% reduction in pain intensity was considered to be a clinically meaningful improvement (22,23); therefore, patients reporting <30% reduction in pain from baseline values were considered to have a poor outcome.

Statistical analysis. Descriptive analyses were carried out to present the course of pain intensity over time. Data were screened for inconsistencies and missing baseline data were imputed using multivariate imputation by chained equations. Five imputations were performed and Rubin's rules were used to combine the results (24). All candidate predictors, relevant baseline measurements, and outcomes were used in the imputation models (25). Continuous variables were checked for normality and transformations were considered to enhance the fit of the imputation models.

Multiple logistic regression analyses were performed to determine which factors, regardless of location, were associated with a risk of poor outcome. The analyses were carried out in 3 steps: 1) derivation of predictive models including generic factors only, 2) investigation of the

Table 1. Baseline characteristics of the cohort and dropouts*

Variable	Baseline cohort (n = 1,043)	Dropouts (n = 80)
Age, mean ± SD years	48.3 ± 14.8	47.0 ± 16.1
Male sex	419 (40.2)	39 (48.8)
Currently a worker with a paid job	627 (60.1)	46 (57.5)
Education		
No school/elementary	110 (10.5)	12 (15.0)
High school equivalent	596 (57.2)	45 (56.2)
Tertiary education	335 (32.2)	23 (28.8)
Neck pain	249 (23.9)	19 (23.8)
Shoulder pain	357 (34.2)	29 (36.3)
Elbow pain	165 (15.8)	16 (20.0)
Wrist/hand pain	209 (20.0)	20 (25.0)
Hip pain	136 (13.0)	11 (13.8)
Knee pain	243 (23.3)	21 (26.3)
Ankle/foot pain	133 (12.8)	9 (11.3)
Duration of complaints		
Acute (<4 weeks)	413 (39.6)	26 (32.5)
Subacute (>4 weeks and <12 weeks)	207 (19.8)	21 (26.3)
Chronic (>12 weeks)	414 (39.7)	32 (40.0)
Pain severity, mean ± SD VAS (range 0–10)	4.79 ± 2.3	4.84 ± 2.18
Had the same complaint in the past year	492 (47.1)	37 (46.2)
Other complaints: low back pain	311 (29.8)	30 (37.5)
Other complaints: pain in many places	94 (9.0)	3 (3.8)
Musculoskeletal pain sites		
1	743 (71.2)	50 (62.5)
2	194 (18.6)	17 (21.3)
3	63 (6.0)	9 (11.3)
4	43 (4.1)	4 (5.0)
Body mass index, mean ± SD kg/m^2	25.98 ± 4.1	26.50 ± 4.76
Days performing physical activity per week, mean ± SD	3.78 ± 2.2	3.58 ± 2.2
How would you rate your health?		
Excellent	114 (10.9)	5 (6.3)
Very good	212 (20.3)	13 (16.3)
Good	544 (52.2)	44 (55.0)
Moderate	164 (15.7)	17 (21.3)
Poor	8 (0.8)	0 (0)
Using pain medication for current complaint	404 (38.7)	28 (35.0)
Smoking		
Yes	303 (29.1)	33 (41.3)
No, only sometimes	395 (37.9)	15 (18.8)
No	345 (33.1)	32 (40.0)
Pain Coping Inventory (active), mean ± SD	24.52 ± 5.7	25.2 ± 5.4
Pain Coping Inventory (passive), mean ± SD	35.13 ± 8.5	35.8 ± 9.6
Distress, mean ± SD	11.01 ± 4.5	11.78 ± 4.9
Kinesiophobia, mean ± SD	23.03 ± 4.1	23.16 ± 4.2
SF-36 vitality, mean ± SD	13.58 ± 2.2	13.79 ± 2.34
SF-36 emotional role functioning, mean ± SD	0.56 ± 1.0	0.69 ± 1.13
SF-36 physical role functioning, mean ± SD	1.83 ± 1.6	1.77 ± 1.66
Social support scale, mean ± SD	18.43 ± 7.7	18.66 ± 8.23

* Values are the number (percentage) unless otherwise indicated. VAS = visual analog scale; SF-36 = Short Form 36 health survey.

added predictive value of pain location, and 3) investigation of effect modification by pain location. Before performing the analyses, the cohort was split depending on the duration of pain prior to the primary care consultation. Separate prognostic models were developed for acute (<4 weeks in duration, n = 413) and chronic (>12 weeks in duration, n = 414) musculoskeletal pain.

For the first step, putative predictors (except for those describing the location of pain) were selected from the list of determinants measured at baseline. A correlation matrix was observed for all potential predictors to check for colinearity. No 2 predictors were highly correlated or removed from the analysis because of this. Continuous variables were checked for a linear relationship between the predictor and the outcome, but no variables were found to have a nonlinear relationship with the outcome. Univari-

able regression analyses were performed to examine the relationship between each of the putative predictors and the outcome measure after 3 months and 12 months of followup. Putative predictors that were associated with the outcome ($P < 0.30$) were included in the multivariable regression model. Since change in pain intensity was used as the outcome, the model was adjusted for baseline pain intensity before entering putative predictors in the model. Manual backward elimination was used to sequentially delete factors until only factors significantly associated with the outcome ($P < 0.05$) were retained in the model. To evaluate the discriminative ability of the models, a receiver operating characteristic curve was generated for the predicted probabilities and the area under the curve (AUC) was calculated (26).

In the second step, pain location variables were added to the model to investigate if these variables added predictive value over the generic factors only. The predictive value of the pain location variables was evaluated by observing the increase in discriminative ability (AUC) for each model.

Finally, in the third step, effect modification of each of the prognostic factors in the generic model with each pain location was tested to see if strength or direction of association between predictors and outcome varied across different pain sites. Significant interactions (a P value less than 0.05) were added to the prognostic model and improvement in discriminative ability was recorded. All statistical analyses were performed with the Stata software package, version 10.1.

RESULTS

The cohort included 1,123 patients with nonspinal musculoskeletal pain. There were 877 patients with no missing data. The percentage of missing baseline values for the candidate predictors ranged from 0.1–6.2%. The baseline characteristics of the patients with imputed data were similar to those of patients with complete cases, so only the analyses on the imputed data are shown. The baseline characteristics of the cohort and of the patients who dropped out of the study (i.e., did not provide any followup measurements [n = 80]) are shown in Table 1. The patients who dropped out were more likely to smoke (41.3%) than those who remained in the study (29.1%). There were no relevant differences on any other baseline characteristics between these patients and those who completed ≥1 followup (n = 1,043), so only those with followup data were included in the analyses.

After 3 months, the mean ± SD pain intensity in the cohort had decreased from 4.8 ± 2.3 to 3.0 ± 2.6 on the 11-point VAS. This decrease in pain intensity was similar for all participants, irrespective of the location of their musculoskeletal pain (Figure 1). At the 3-month followup, 45.7% of the cohort had a poor outcome (<30% decrease in pain intensity from baseline). At the 12-month followup, the mean ± SD pain intensity was 2.6 ± 2.6, and 35.2% of the cohort had a poor outcome (Table 2).

A total of 413 patients with acute musculoskeletal pain (<4 weeks in duration) and 414 patients with chronic musculoskeletal pain (>12 weeks in duration) had complete followup data and were included in the prediction model analysis. Those patients with subacute musculoskeletal pain (n = 216) were excluded from further analysis.

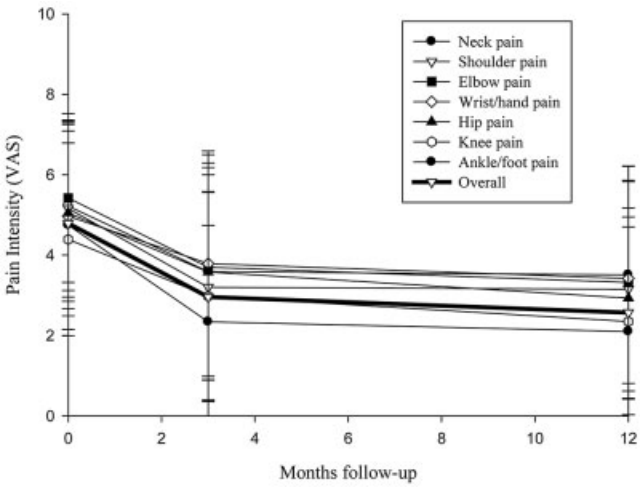

Figure 1. Clinical course of nonspinal musculoskeletal pain intensity (mean ± SD) in primary care patients (n = 1,043). VAS = visual analog scale.

Model 1a: predictors of a poor outcome after 3 months in patients with acute pain. For patients with acute musculoskeletal pain, the generic factors that predicted a poor outcome at 3 months were a low level of education, having had the same complaint in the past year, and a low level of social support. The AUC for this model with generic factors was only 0.70 (95% confidence interval [95% CI] 0.65–0.76).

None of the variables related to pain location significantly added to the generic model. There was a significant interaction concerning patients with shoulder pain, in that those with a lower level of social support were more likely to have a poor outcome than participants with other pain problems who reported a lower level of support. The AUC for the final model, including the interaction term, was slightly increased to 0.73 (95% CI 0.68–0.78) (Table 3).

Model 1b: predictors of a poor outcome after 12 months in patients with acute pain. The generic factors that predicted a poor outcome after 12 months in patients with acute musculoskeletal pain included a low level of education, having had the same complaint in the past year, reporting musculoskeletal pain in many places, and having lower scores on the SF-36 vitality subscale. The AUC for the model was 0.73 (95% CI 0.67–0.78). No pain location variables significantly added to the model with generic factors only. No interaction terms between pain locations and the generic factors significantly added to the model (Table 3).

Model 2a: predictors of a poor outcome after 3 months in patients with chronic pain. For patients presenting with chronic musculoskeletal pain, the generic factors that predicted a poor outcome at 3 months were having had the complaint before in the past year, a low level of education, using pain medication at baseline, being more bothered by

Table 2. Pain intensity at baseline, 3 months, and 12 months by pain location and acute and chronic pain status*

	No.†	Baseline pain intensity	3-month pain intensity	Poor outcome at 3-month followup, %	12-month pain intensity	Poor outcome at 12-month followup, %
Location						
Neck	249	5.22 ± 2.1	3.59 ± 2.7	51.8	3.51 ± 2.7	48.8
Shoulder	357	5.16 ± 2.2	3.2 ± 2.8	45.6	3.15 ± 2.7	43.0
Elbow	165	5.42 ± 2.1	3.7 ± 2.8	54.3	3.32 ± 2.9	40.5
Wrist/hand	209	4.97 ± 2.3	3.79 ± 2.8	58.6	3.42 ± 2.8	47.1
Hip	136	5.05 ± 2.2	3.58 ± 2.6	51.2	2.93 ± 2.9	42.4
Knee	243	4.39 ± 2.4	2.98 ± 2.6	48.0	2.35 ± 2.6	33.1
Ankle/foot	133	4.75 ± 2.6	2.34 ± 2.4	38.5	2.10 ± 2.6	24.9
Acute	413	4.60 ± 2.5	2.02 ± 2.3	33.0	1.91 ± 2.4	27.3
Chronic	414	4.97 ± 2.3	3.86 ± 2.7	58.6	3.29 ± 2.7	46.7
Total	1,043	4.79 ± 2.3	2.96 ± 2.6	45.7	2.57 ± 2.6	35.2

* Values are the mean ± SD unless otherwise indicated. A poor outcome is defined as having <30% improvement in pain intensity from baseline.
† Number of patients reporting pain at each location. Because of patients with multiple pain sites, the subgroups are not mutually exclusive.

the complaint in the past 3 months, and higher scores on the SF-36 physical role functioning subscale. The AUC for the generic model was 0.71 (95% CI 0.66–0.77).

When variables on the location of pain were added to the generic model, there were no significant changes. Significant interactions were observed between neck pain and using pain medication at baseline, between neck pain and having had the complaint in the past year, and between knee pain and the SF-36 physical role functioning subscale (Table 4), indicating that a few prognostic factors had a different association with the outcome in specific regional pain problems. The AUC for the final model was only slightly greater than the generic model predicting poor outcome at 3 months (0.74, 95% CI 0.69–0.79).

Model 2b: predictors of a poor outcome after 12 months in patients with chronic pain. The generic factors that predicted a poor outcome in patients with chronic musculoskeletal pain after 12 months were using pain medication at baseline, having had the complaint before in the past year, being more bothered by the complaint in the past 3 months, and lower scores on the SF-36 vitality subscale. The AUC for the model with generic factors was only 0.72 (95% CI 0.67–0.77).

When the variables on pain location were added to the generic model, the presence of wrist/hand pain and hip pain was significantly associated with a poor outcome. The AUC after these variables were added to the model was 0.74 (95% CI 0.69–0.79). A significant interaction was

Table 3. Predictors of poor outcome in patients with acute musculoskeletal pain (n = 413) after 3 and 12 months*

	3 months			12 months		
Predictors	Poor outcome, no./total (%)	OR (95% CI)	*P*	Poor outcome, no./total (%)	OR (95% CI)	*P*
Baseline pain intensity (range 0–10)†		0.73 (0.65–0.81)	0.00		0.81 (0.73–0.90)	0.00
Highest level of education						
None/primary	19/37 (51)	1.00		14/37 (38)	1.00	
High school	79/238 (33)	0.44 (0.17–1.12)	0.08	74/238 (31)	0.76 (0.34–1.73)	0.52
Tertiary	39/134 (29)	0.30 (0.12–0.75)	0.01	25/134 (19)	0.35 (0.14–0.85)	0.02
Had complaint before in the past year						
No	99/311 (32)	1.00		70/311 (23)	1.00	
Yes, once	13/40 (33)	1.03 (0.47–2.26)	0.94	15/40 (38)	2.25 (1.06–4.78)	0.04
Yes	25/57 (44)	2.15 (1.12–4.13)	0.02	28/57 (49)	3.46 (1.83–6.56)	0.00
Do you have complaints elsewhere? (many places)				14/21 (67)	5.58 (1.73–17.94)	0.01
SF-36 vitality subscale†					0.92 (0.86–0.98)	0.02
Social support scale (per point)†		1.02 (0.98–1.06)	0.32			
Shoulder pain	40/133 (30)	0.20 (0.05–0.77)	0.02			
Shoulder pain × social support scale (interaction)		1.09 (1.02–1.17)	0.02			

* Comparison of the generic model presenting poor outcome at 3 months and the final model area under the curve (AUC) 0.73, SE 0.03 (95% confidence interval [95% CI] 0.68–0.78). Comparison of the generic model predicting poor outcome at 12 months and the final model AUC 0.73, SE 0.03 (95% CI 0.67–0.78). OR = odds ratio; SF-36 = Short Form 36 health survey.
† A higher score means more intense pain, more vitality, and lower social support.

Table 4. Predictors of poor outcome in patients with chronic musculoskeletal pain (n = 414) after 3 and 12 months*

Predictors	3 months			12 months		
	Poor outcome, no./total (%)	OR (95% CI)	*P*	Poor outcome, no./total (%)	OR (95% CI)	*P*
Baseline pain intensity (range 0–10)†		0.81 (0.72–0.92)	0.00		0.93 (0.83–1.04)	0.23
Medication use (pain killers)	112/154 (73)	1.74 (0.97–3.13)	0.06	96/154 (62)	2.17 (1.31–3.59)	0.00
Had complaint before in the past year						
No	44/97 (45)	1.00		34/97 (35)	1.00	
Yes, once	11/26 (42)	1.02 (0.37–2.82)	0.97	5/27 (19)	0.52 (0.16–1.65)	0.27
Yes	189/288 (66)	2.71 (1.53–4.81)	0.00	155/288 (54)	2.03 (1.18–3.49)	0.01
How often during the past 3 months were you bothered by the complaint? (4-point scale)†		0.64 (0.46–0.90)	0.01		0.54 (0.36–0.80)	0.00
Highest level of education						
None/primary	40/52 (77)	1.00				
High school	139/227 (61)	0.50 (0.22–1.16)	0.10			
Tertiary	64/132 (48)	0.35 (0.14–0.83)	0.02			
SF-36 physical subscale†		1.46 (1.21–1.77)	0.00			
SF-36 vitality subscale†					0.89 (0.84–0.95)	0.00
Neck pain	63/98 (64)	1.54 (0.36–6.48)	0.56			
Medication use × neck pain (interaction)		3.82 (1.15–12.69)	0.03			
Had complaint before in the past year × neck pain (interaction)		0.42 (0.19–0.90)	0.03			
Knee pain	66/114 (58)	2.21 (1.07–4.57)	0.03			
SF-36 physical subscale × knee pain (interaction)		0.62 (0.45–0.86)	0.00			
Hip pain				40/65 (62)	2.20 (1.02–4.75)	0.04
Wrist/hand pain				59/95 (62)	0.60 (0.17–2.03)	0.41
Had complaint before in past year × wrist/hand pain (interaction)					2.09 (1.03–4.24)	0.04

* 3/12 area under the curve (AUC) 0.74, SE 0.03 (95% confidence interval [95% CI] 0.69–0.79). 12/12 AUC 0.75, SE 0.02 (95% CI 0.70–0.79). OR = odds ratio; SF-36 = Short Form 36 health survey.
† A higher score means more pain, the complaint being less bothersome in the past 3 months, more vitality, and less physical symptoms.

observed between wrist/hand pain and having had the complaint before in the past year. The AUC for the final model, including this interaction, was 0.75 (95% CI 0.70–0.79) (Table 4).

DISCUSSION

This study has shown that a number of factors act as consistent predictors of outcome regardless of the location of a musculoskeletal pain complaint. These generic factors predicted outcome over different time periods (3 months and 12 months) and for both acute and chronic musculoskeletal pain. The most consistent predictor of poor outcome was having had the same complaint in the previous year (odds ratio range 2.03–3.46), which was present in all 4 models. Other factors that were predictive of poor outcome in >1 model included a lower level of education, lower scores on the SF-36 vitality subscale, using pain medication at baseline, and being bothered by the complaint more often in the past 3 months.

The 1-year course of pain intensity from different regional pain complaints showed a similar pattern across bodily regions. There appeared to be a rapid reduction of pain intensity in the first 3 months, followed by a slower improvement over the next 9 months. Approximately 30–40% of patients had a poor outcome 1 year after consulting a primary care clinician, with a large variation between patients presenting with acute (27%) or chronic (47%) pain. These results are comparable to other studies on the clinical course of musculoskeletal complaints (27) and low back pain (28). The similarity in clinical course across various studies, even with 30% of patients presenting with >1 regional pain complaint, supports the contention that these complaints share common attributes. The models developed in this study show that these common factors can determine whether a patient will recover rapidly or continue to have symptoms over an extended period of time.

Having a previous history of complaints has been consistently identified as a predictor of poor prognosis in studies on patients with musculoskeletal pain (9) as well as being predictive of future episodes (recurrences) of low back pain (29). The importance of effective management of musculoskeletal conditions in primary care and development of preventive strategies for recurrences appears crucial to address this issue. Another consistent predictive factor in this study was the level of highest education attainment of the participants. In 3 of the 4 models derived

in this study, patients with a low level of education were most likely to experience a poor outcome. While level of education has been linked to the onset and severity of musculoskeletal pain (30,31), fewer studies have attempted to explore the causal relationship between education attainment and health outcomes. Higher socioeconomic status is associated with better general heath, lower prevalence of chronic diseases, and a more healthy lifestyle, but it is also possible that a higher level of education is related to a higher level of self-efficacy and health-related knowledge, or that these patients are more likely to adhere to exercise and treatment programs (32,33). Future research is warranted to explore the relationship between these factors and outcome from musculoskeletal pain, the influence of socioeconomic status on the process of recovery, as well as whether interventions can be developed to modify this relationship.

When the variables on pain location were added to the models with generic factors only, the association between generic factors and outcome was only slightly modified and the findings were inconsistent. There were very few interactions between prognostic factors and pain location, indicating that most prognostic variables are of similar importance in patients consulting for different types of regional pain. This strengthens the argument that it is not the location of pain that is of great importance, but other dimensions of the pain problem that determine the outcome of an episode of musculoskeletal pain. However, similar to most other studies of musculoskeletal pain prognosis, the explained variance for our models was modest (AUC ~0.74). This suggests that the variables entered into the models may not have truly represented those that are important for predicting outcome, or there was a large measurement error associated with both the predictors and the outcome. The choice of outcome measure can also have a substantial influence on which factors are considered predictive and the strength of a predictive model. As the intensity of baseline pain was included in the models, it was observed that patients with higher baseline pain intensity were more likely to improve by ≥30%. This highlights one caveat of using a change score as an outcome (rather than absolute values) in that those with higher scores at baseline have a higher probability of achieving a 30% reduction than those with low scores at baseline. However, when the analyses in this study were repeated using self-reported recovery (asking at 3 and 12 months whether patients still had the original complaint), the results in terms of predictive variables and explained variance were similar to those presented (Henschke N: unpublished observations).

The results of this study confirm the importance of a small set of generic factors when estimating which patients with musculoskeletal pain are at risk of poor outcome. Further research is needed to investigate the impact and prognosis of musculoskeletal pain with respect to these generic factors. The similarities observed in the prognosis of different musculoskeletal pain complaints and the identification of consistent generic predictors support a move toward the development of a core set of features for the assessment of all musculoskeletal pain conditions.

AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be published. Dr. Henschke had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study conception and design. Henschke, Ostelo, Terwee, van der Windt.

Acquisition of data. Terwee, van der Windt.

Analysis and interpretation of data. Henschke, Ostelo.

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